ARAPAHO NATIONAL WILDLIFE REFUGE COMPLEX
HUTTON LAKE NWR, BAMFORTH LAKE NWR,
MORTENSON LAKE NWR SATELLITES

ANNUAL WATER MANAGEMENT PLAN
1999 WATER USE REPORTS
2000 RECOMMENDATIONS

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ANNUAL WATER MANAGEMENT PLAN 1999-2000
Arapaho National Wildlife Refuge

I. Introduction

Arapaho National Wildlife Refuge uses five primary sources of water to provide irrigation, maintain pond levels and sustain riparian vegetation for wildlife. These five sources are the Illinois River, Spring Creek, Antelope Creek, Soap Creek and Potter Creek. Sixteen different headgate structures divert water out of the Illinois River into more than 70 miles of primary delivery ditches. This water supplies over 77 ponds with over 807 surface acres of water and irrigates over 8,000 meadow acres during a normal year.

In 1999, the Illinois River opened in late March with flows peaking in mid-May. Actual flow of the River is not known, as the headquarters bridge river gauge was removed in 1995 for construction purposes. The gauge has not been replaced at this time, but we are still hoping to get it replaced in the near future. By mid-July, the River had dropped to average summer flows which were maintained until the River froze in mid November.

Headgates were opened in early to mid April and ditches were ice free by late April. Wetland conditions for the spring were excellent with all ponds full and meadows irrigated. Most headgates were closed in mid-July to help maintain flows in the River. Wetland conditions remained average through July and into August, with some wetlands dry or less than half full by late August.

Precipitation in 1999 was 12.94 inches, 3.39 inches above normal, with snowfall measuring 68.8 inches in Walden. A new record high of 67° Fahrenheit was set in November. Snow pack levels in the Illinois River drainage were 85% of normal as of January 2000. The outlook for good spring runoff flows is questionable if snow levels do not increase over the winter months.

II. Purpose and Methods

Spring run-off is diverted from natural water courses into delivery ditches to provide wetlands and irrigation systems with water. Approximately 8,000 acres of meadows are flood irrigated to maintain and perpetuate quality nesting habitat for waterfowl, shorebirds and other wetland dependent birds. Numerous ponds are also managed via diverted water each year to provide breeding and brood rearing habitat for these same birds.

Current water management practices greatly depend on winter snow packs, spring moisture and downstream water demands. Future water management practices will address the Refuge's depletion issues and work toward keeping depletions at the current average level. At this time the Refuge is looking to obtain junior water storage rights before the year end

Howard - half of the flume acre feet reading, the Refuge has 50% of the water right.

Everhard Baldwin - The Refuge owns 47% of the total acre feet, thus the flume acre feet reading is multiplied by .47.

The Oklahoma #1 flume reading is influenced by large volumes of non-Refuge secondary water during the irrigation season. So in many cases the total acre feet reading for this ditch is much higher than what is actually diverted by the Refuge. If possible, total acre feet should be an estimated amount of the flume reading and/or the headgate should be closed during the irrigation season.

IV. Proposed 2000 Water Use

Water use in 2000 will be influenced by the final decision made on if junior storage rights on the ponds is the proper way to address Refuge water issues. An effort to more efficiently manage our water system will begin this year by cleaning identified ditches, better learning the ditch system by permanent employees and active irrigation efforts. Optimum water levels will be maintained for as long as possible to encourage waterfowl and other wetland dependent birds breeding, nesting and brood rearing.

One of the following general plans will be implemented dependent upon the availability of water in 2000:

Plan A - Average Water Year

1. Refuge ponds will be filled as early as possible to attract spring migrants to remain and nest. Two to three ponds will be held at 80 percent capacity to provide shoreline habitat for migrating shorebirds during May and early June.

2. Meadow areas will be irrigated by take-outs in the diversion ditches or sub-irrigated by seepage from the ditches.

3. As many ponds as possible will be maintained at optimum levels for as long as possible. If necessary some ponds may be sacrificed for more important brood ponds later in the summer.

4. Following the upstream irrigation season of hay meadows, increased flow in the Illinois River may be used to refill some ponds in order to provide fall migrational habitat and reserve water for the following year.

Plan B - Extremely Wet Water Year

1. Marginal meadow areas not normally irrigated will be irrigated to provide additional wetland habitat for wildlife.

2. Additional water will be circulated through impoundments keeping them fresh, which will aid in the production of emergent and submergent vegetation and encourage invertebrates as sources of food and cover for wildlife.

3. Four to six ponds will be held at 80 percent capacity to provide shoreline habitat for migrating shorebirds during May and early June.

4. Water will run longer in the season keeping ponds relatively full at freeze-up. This will help ensure that at least some water will be available the following spring even in the event of a dry year.

5. By running the water longer, many small wetland depressions in the meadows can be maintained as brood rearing habitat, thus preventing concentrations of broods on a few ponds where they are more susceptible to predation and disease outbreaks.

Plan C - Extremely Dry Water Year

1. Fill as many ponds as possible to capacity and maintain to provide water for breeding and nesting pairs and cover for broods and molters.

2. Irrigate Refuge meadows adjacent to permanent bodies of water.

3. Irrigate Refuge meadows further removed from permanent ponds as available water permits.

4. Review implementation of drawdowns to conserve as much water in the most important ponds for as long as possible.

V. Planned Drawdown

A new drawdown plan was established last year, initiated in the fall and will continue this year. Lack of water can effectively result in an unscheduled drawdown for certain ponds and may be used as such even if it does not coincide with the existing plan (Table III).

Water management is sometimes dictated by priorities set for rehabilitation of dikes and control structures. Rehabilitation will still play a role in selecting which ponds to draw down.

VI. Comments and Problems

The following water management related projects were accomplished in 1999.

1. Horseshoe dike was rehabilitated and a new water control structure was installed.
2. A leaking take-out was reset in the Caudal ditch near Smith Pond.
3. Restoration of the West Fish Hatchery dike was initiated and will be completed in 2000.
4. Water control structures were installed in Rodriguez, N. & S. Hackley and Headwaters.
5. Rip-rap was hauled to all the above dikes.
6. The culvert in Home ditch was rehabilitated.
7. Several blowouts in the Oklahoma #1 were patched.
8. The water control structure in N. School Section was rehabilitated.
9. Germ ditch was cleaned out and a culvert was installed in the road south of Rodriguez pond.
10. A large number of beaver dams were removed from the Hubbard #4 ditch and take-outs were cleaned out.

The following work, not in priority order, is needed and will be accomplished as manpower and working conditions permit:

1. Replace the water control structure in Hampton #2 pond.
2. Determine surface acreage and storage capacity for several existing ponds and all new ponds to verify surface acres and storage capacities.
3. Install and or rehab Parshall flumes as needed, including Midland Extension, Midland Anderson, Midland Ross, Hubbard #4.
4. Replace deteriorating or missing river headgates on the Hubbard #2, Hill & Crouter, Dryer, Ward #2, and Ish Baldwin ditches.
5. Continue ditch clean-outs as time and money permit (by contract if possible).

6. Measure capacity of Fish Hatchery spring (Potter Creek) to determine amount of water flowing into Potter #2 ditch.

7. Rehab North Allard Contour and Case #3 Contour dikes.

8. Rehab blowouts in Caudal ditch and construct water gap on Riddle ditch.

9. Construction of Graf, Schroeder, Willet and Wigeon ponds on Soap Creek and Hampton tracts.

Table I - Dry Year Contingency

Headgate Name	Restrictions	Schedule
Boyce Brothers	Refuge has full water right.	Adjust flow rates and timing.
Dryer	Refuge has full water right.	Shorten time frame with lower flow rates or dry up.
Everhard Baldwin	Shared water right.	Refuge does not have control of headgate.
Hill & Crouter	Refuge has full water right	Shorten time frame that ditch runs.
Home #1	Shared water right	Refuge must provide water to private landowner downstream.
Howard	Shared water right	Refuge does not have control of headgate.
Hubbard #1	Refuge has full water right	Adjust flow rates and timing.
Hubbard #2	Refuge has full water right	Adjust flow rates and timing.
Ish Baldwin	Shared water right	Does not have a functioning headgate
Midland	Shared water right	Refuge does not have control of headgate.
North Park #6	Refuge has full water right	Shorten time frame with lower flow rates or dry up.
Oklahoma #1	Refuge has full water right	Open in April, close during irrigation season, re-open after irrigation if needed.
Oklahoma #2	Refuge has full water right	Adjust timing of opening and closing.
Ward #1	Refuge has full water right	Adjust flow rates and timing.
Ward #2	Refuge has full water right	Headgate not operable. Fix or close down?
Ward #3	Refuge has full water right	Shorten time frame with lower flow rates or dry up.

Table II - Total Refuge Diversions

DITCH	REFUGE 1999 ACRE FEET DIVERTED	REFUGE 1998 ACRE FEET DIVERTED	REFUGE 1997 ACRE FEET DIVERTED
Antelope**	225	225	250
Boyce Brothers	950	415	1468
Dryer	203	38	253
Everhard Baldwin	1345	1116	1003
Hill & Crouter	78	64	268
Home #1	912	738	2222
Howard	1763	1208	1320
Hubbard #1	287	163	75
Hubbard #2	5425	5389	7485
Hubbard #3 (Rat)*	945	705	708
Hubbard #4*	2287	2243	3000
Hubbard Caudle*	2193	2441	2557
Ish Baldwin**	100	100	150
Midland (Ross)	1707	1431	2364
Midland (Hackley)	241	262	261
Midland (Curtis)	1235	765	-
North Park #6	519	229	714
Oklahoma #1	596	1041	1365
Oklahoma #2	820	82	1012
Potter #2**	175	175	200
Riddle Ditch	649	573	752
State Walden**	500	500	500
State Walden Res.**	35	35	35
Ward #1	1310	1152	2844
Ward #2**	210	76	504
Ward #3	214	152	73
TOTAL	19499	15929	25118

* Recorded under Hubbard #2.
** These figures are estimates.

Table III - Pond Drawdown Schedule

POND	DATE	PRESCRIPTION	STATUS
Home Pond	October 1998	Release water to Illinois River. Keep pond dry through summer refill fall of 1999.	Water released pond dry in November. Pond kept 1/4 full to supply downstream user.
Hampton #2 Pond	Late October 1998	Release water to Potter Creek. Keep pond dry through summer, refill fall of 1999.	Water released pond dry in November. Pond will remain dry through fall of 2000 to finish dike work.
W. Fish Hatchery	October 1998	Release water to E. Fish Hatchery. Keep pond dry through summer, refill fall of 1999.	Water released pond dry in November. Pond will remain dry through fall of 2000 to finish dike work.
Eagle Pond	Late October 1999	Release water into Rat Ditch. Keep pond dry through summer, refill fall of 2000.	On Schedule.
Elk Pond	October 1999	Release water to '76 and Reservoir #2. Keep pond dry through summer, refill fall of 2000.	On Schedule.
Reservoir #1	Tentatively October 2000 If MMS funding for dike rehab can be obtained.	Release water to Goose Pond. Keep pond dry through summer and fall, refill spring of 2001.	On Schedule.
S. School Section Pond	October 2000	Release water to N. School Section. Keep pond dry through summer refill fall of 2001.	On Schedule.
Brocker Pond	October 2000	Release water to meadow. Keep pond dry through summer, refill fall of 2001.	On Schedule.
Birdie Pond	Late October 2001	Release water to Rat Ditch. Keep pond dry through summer, refill fall of 2002.	On Schedule.
Reservoir #2	October 2001	Release water to Annex Pond. Keep pond dry through summer, refill fall of 2002.	On Schedule.

Schedule is subject to change if dike work is needed on a specific pond.

YEAR POND CONST.	POND NAME	POND POINT OF DIVERSION QTR(S) - SEC - TWN - RGE	SURFACE ACRES	A F CAP	SOURCE	REMARKS
DITCH:	BOYCE BROTHERS DITCH	MEAS. FLUME: Y		ANNUAL AF AMOUNT DIVERTED:	950	
1980	BROCKER POND, NORTH	NE 4 8N 79W	14.95	37	ILLINOIS RIVER	
		Ditch Total - Pond Use:	14.95 ----	37 AF		
DITCH:	HOME DITCH #1	MEAS. FLUME: Y		ANNUAL AF AMOUNT DIVERTED:	912	

Variable not found: TTLDIV99
ttlirrig=TTLDIV99-TTL99CAP
** At line 179 in file pondonly.frg, procedure UPD_VARS
from line 295 in file pondonly.frg, procedure __DETAIL
from line 130 in file pondonly.frg, procedure PONDONLY
from dot prompt
Cancel 04/05/2000 ARAPAHO NWR - POND USE Page No.
1999 DITCH DIVERSIONS

YEAR POND CONST.	POND NAME	POND POINT OF DIVERSION QTR(S) - SEC - TWN - RGE	SURFACE ACRES	A F CAP	SOURCE	REMARKS
DITCH:	BOYCE BROTHERS DITCH	MEAS. FLUME: Y		ANNUAL AF AMOUNT DIVERTED:	950	
1980	BROCKER POND, NORTH	NE 4 8N 79W	14.95	37	ILLINOIS RIVER	
		Ditch Total - Pond Use:	14.95 ----	37 AF		
DITCH:	HOME DITCH #1	MEAS. FLUME: Y		ANNUAL AF AMOUNT DIVERTED:	912	
1978	HOME POND	NW SW N 33 9N 79W	27.05	68	ILLINOIS RIVER	
		Ditch Total - Pond Use:	27.05 ----	68 AF		
DITCH:	HUBBARD DITCH #2	MEAS. FLUME: Y		ANNUAL AF AMOUNT DIVERTED:	5,425	
1976	BIRDIE POND	SW 20 8N 80W	3.44	9	ILLINOIS RIVER	to #3, #4 & Hub/Caudle
1976	EAGLE POND	NW NW S 20 8N 80W	7.74	22	ILLINOIS RIVER	to #3, #4 & Hub/Caudle
1985	SOLBERG POND	S1/2 SW 20 8N 79W	8.60	22	ILLINOIS RIVER	to #3, #4 & Hub/Caudle
		Ditch Total - Pond Use:	19.78 ----	53 AF		
DITCH:	HUBBARD DITCH #3 (Rat) - #2 Lateral	MEAS. FLUME: Y		ANNUAL AF AMOUNT DIVERTED:	0	
1974	ANTELOPE POND	N1/2 SW 7 8N 80W	22.42	77	ANTELOPE SPRINGS	
1972	BUDDY'S POND	SE 13 8N 80W	6.93	17	ILLINOIS RIVER	
1987	DIVERSION POND	SE 20 8N 79W	7.93	20	ILLINOIS RIVER	
1986	EISEMANN POND	NW SE 18 8N 80W	5.29	15	ILLINOIS RIVER	
NATL	GOOSE POND	SE 13 8N 80w	15.52	49	ILLINOIS RIVER	& #4
1972	LIVING ROOM POND	SE NE S 13 8N 80W	2.41	6	ILLINOIS RIVER	& #4
NATL	MARSH POND	SE 13 8N 80W	12.58	31	ILLINOIS RIVER	& #4
1985	MUSKRAT POND	NW 7 7N 80W	99.00	390	ILLINOIS RIVER	& #4 DECREED
1987	OLD ROAD POND	NW 20 8N 79W	1.87	5	ILLINOIS RIVER	
1986	PATTEN POND	SW SE 18 8N 79W	3.30	10	ILLINOIS RIVER	
1986	PRAIRIE DOG POND	SW NE S 18 8N 79W	4.95	18	ILLINOIS RIVER	
1987	RAT DITCH POND	NW 20 8N 79W	2.82	7	ILLINOIS RIVER	
1972	ROADSIDE POND, NORTH	SW SE N 12 8N 80W	2.24	6	ILLINOIS RIVER	& #4
1972	ROADSIDE POND, SOUTH	SE NW N 13 8N 80W	2.42	6	ILLINOIS RIVER	& #4

YEAR POND CONST.	POND NAME	POND POINT OF DIVERSION QTR(S) - SEC - TWN - RGE				SURFACE ACRES	A F CAP	SOURCE	REMARKS
1993	HEADWATERS POND	NE SW	24	8N	80W	11.90	30	ILLINOIS RIVER	
1975	HORSESHOE POND	SE NE	15	8N	80W	0.92	2	ILLINOIS RIVER	
NATL	KITCHEN POND	SW	13	8N	80W	4.07	10	ILLINOIS RIVER	
1979	N. TOUR ROUTE POND	SE	14	8N	80W	0.76	2	ILLINOIS RIVER	
1974	POTTER CREEK POND	NE SE	12	8N	80W	35.98	111	ILLINOIS RIVER	
1979	S. TOUR ROUTE POND	SE	14	8N	80W	0.76	2	ILLINOIS RIVER	
1986	VARNEY POND	N1/2 SW	19	8N	79W	9.71	24	ILLINOIS RIVER	
1978	WILSONS POND	SW SW S	11	8N	80W	6.75	17	ILLINOIS RIVER	
		Ditch Total - Pond Use:				285.53 ----	865 AF		

DITCH: HUBBARD/CAUDLE EXT - Hubbard #2 Lateral MEAS. FLUME: Y ANNUAL AF AMOUNT DIVERTED: 0

1992	403 POND	NE NW	18	8N	79W	0.50	1	ILLINOIS RIVER	
1992	404 POND	NW NE	18	8N	79W	3.18	8	ILLINOIS RIVER	
1987	ABRAHAM POND	NE	20	8N	79W	6.25	20	ILLINOIS RIVER	
1987	FOLLETT POND	NW	20	8N	79W	2.99	10	ILLINOIS RIVER	
1990	HAMPTON #1 POND	SE	5	8N	79W	1.14	3	ILLINOIS RIVER	
1977	HAMPTON #2 POND	NE SE	5	8N	79W	6.67	22	ILLINOIS RIVER	
1978	HAMPTON #3 POND	NW SE	5	8N	79W	7.46	25	ILLINOIS RIVER	
1987	RIZOR POND	NE	20	8N	79W	3.51	11	ILLINOIS RIVER	
1981	SMITH POND	SW SE N	20	8N	79W	8.03	20	ILLINOIS RIVER	
		Ditch Total - Pond Use:				39.73 ----	120 AF		

DITCH: MIDLAND-HACKLEY DITCH MEAS. FLUME: Y ANNUAL AF AMOUNT DIVERTED: 241

1974	GERM POND	SW NE	12	7N	80W	7.54	28	ILLINOIS RIVER	
		Ditch Total - Pond Use:				7.54 ----	28 AF		

DITCH: MIDLAND-ROSS DITCH MEAS. FLUME: N ANNUAL AF AMOUNT DIVERTED: 1,707

1993	HACKLEY POND NORTH	SW SW	12	7N	80W	4.30	11	ILLINOIS RIVER	
1993	HACKLEY POND SOUTH	SW SW	12	7N	80W	3.60	9	ILLINOIS RIVER	
1993	RODRIQUEZ POND	NW NE	12	7N	80W	11.07	28	ILLINOIS RIVER	
1982	ROSS POND	SE NE	1	8N	80W	4.37	11	ILLINOIS RIVER	
		Ditch Total - Pond Use:				23.34 ----	59 AF		

DITCH: NATL RUNOFF-NO DITCH MEAS. FLUME: N ANNUAL AF AMOUNT DIVERTED: 0

1992	FOX POND	SE NW N	10	8N	79W	48.00	108	SPRING CREEK	decreed
1980	SPRING CREEK POND	S1/2 NE	15	8N	79W	26.15	63	SPRING CREEK	decreed
		Ditch Total - Pond Use:				74.15 ----	171 AF		

DITCH: OKLAHOMA DITCH #1 MEAS. FLUME: Y ANNUAL AF AMOUNT DIVERTED: 596

1981	ALLARD CONTOUR, MIDDLE	S1/2 NW	29	8N	79W	4.03	10	ILLINOIS RIVER	
1981	ALLARD CONTOUR, NORTH	N 1/2	29	8N	79W	2.85	7	ILLINOIS RIVER	
1981	ALLARD CONTOUR, SOUTH	NW	29	8N	79W	4.43	11	ILLINOIS RIVER	
NATL	ANDERSON CONTOUR	S1/2	5	7N	79W	9.06	23	ILLINOIS RIVER	
NATL	ANDERSON DRAIN	S1/2	5	7N	79W	14.01	35	ILLINOIS RIVER	
1979	COYOTE POND	SW	20	8N	80W	1.52	4	ILLINOIS RIVER	
NATL	FISHERMAN'S PARKING POND	NE	5	7N	79W	0.37	1	ILLINOIS RIVER	
1970	POTHOLE POND	NW	5	8N	79W	3.40	9	ILLINOIS RIVER	
		Ditch Total - Pond Use:				39.67 ----	100 AF		

YEAR POND CONST.	POND NAME	POND POINT OF DIVERSION QTR(S) - SEC - TWN - RGE	SURFACE ACRES	A F CAP	SOURCE	REMARKS
DITCH:	OKLAHOMA DITCH #2	MEAS. FLUME: Y		ANNUAL AF AMOUNT DIVERTED: 820		
1978	ALLARD POND, NORTH	NW SW N 5 8N 79W	13.98	38	ILLINOIS RIVER	
1978	ALLARD POND, SOUTH	SW NE S 5 8N 79W	15.16	48	ILLINOIS RIVER	
		Ditch Total - Pond Use:	29.14 ----	86 AF		
DITCH:	POTTER DITCH #2	MEAS. FLUME: N		ANNUAL AF AMOUNT DIVERTED: 175		
1950	EAST FISH HATCH POND	NW SE 15 8N 80W	2.19	8	FISH HATCHERY SPRING	DECREED*STATE-WALDEN RES
1950	WEST FISH HATCH POND	N1/2 S1 15 8N 80W	0.93	2	FISH HATCHERY SPRING	DECREED*STATE-WALDEN RES
		Ditch Total - Pond Use:	3.12 ----	10 AF		
DITCH:	WARD DITCH #1	MEAS. FLUME: Y		ANNUAL AF AMOUNT DIVERTED: 1,310		
1972	MCCAMMON POND, NORTH	NW NE N 21 8N 79W	3.52	9	ILLINOIS RIVER	
1978	MCCAMMON POND, SOUTH	SE NW N 21 8N 79W	13.68	41	ILLINOIS RIVER	
1980	WILLFORD POND	NW NE N 15 8N 79W	15.55	62	ILLINOIS RIVER	
		Ditch Total - Pond Use:	32.75 ----	112 AF		
DITCH:	WARD DITCH #3	MEAS. FLUME: Y		ANNUAL AF AMOUNT DIVERTED: 214		
1978	SCHOOL POND, NORTH	S1/2 NW 16 8N 79W	11.13	30	ILLINOIS RIVER	* AND HUBBARD DITCH #1
1978	SCHOOL POND, SOUTH	SW SW S 16 8N 79W	10.65	27	ILLINOIS RIVER	* AND HUBBARD DITCH #1
		Ditch Total - Pond Use:	21.78 ----	57 AF		

YEAR POND CONST.	POND NAME	POND POINT OF DIVERSION QTR(S) - SEC - TWN - RGE	SURFACE ACRES	A F CAP	SOURCE	REMARKS

The majority of water diverted is utilized for meadow irrigation. The amount captured in ponds is incidental to this irrigation.
Note: Use under Hubbard #3,

#4 and Hubbard Caudle Extn. are included under Hubbard #2 Ditch totals.

MEADOW IRRIGATION No Ponds	ANNUAL AF DIVERTED
ANTELOPE DITCH	225
DRYER DITCH	203
EVERHARD & BALDWIN DITCH	1,345
HILL & CROUTER DITCH	78
HOWARD DITCH	1,763
HUBBARD DITCH #1	287
ISH & BALDWIN DITCH	100
MIDLAND-CURTIS	1,235
NORTH PARK DITCH #6	519
RIDDLE DITCH	649
STATE WALDEN PIPELINE	500
STATE WALDEN RES.	35
WARD DITCH #2	210

** Plus ACRE FEET TOTAL: 7,149

T O T A L S

POND Surface Acres - 808

DITCH DIVERSION - 12,350 AF ** GRAND TOTAL 19,499 AF

POND CAPACITY - 2,423 AF

Pond & Meadow Irrigation - 9,927 AF ** GRAND TOTAL 17,076 AF